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Challenging otitis cases – from diagnosis to treatment

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Canine otitis – still a challenge for the practicing vet?

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Anatomy of the external and middle ear

The external ear consists of a vertical part, forming a medial turn, which leads to the horizontal part. They are composed of two different cartilaginous tubes. The end of the horizontal part is connected with the osseous external acoustic meatus. As the external ear canal is lined by skin, it contains hair follicles, sebaceous glands and ceruminous glands, which are modified apocrine glands. The length of the ear canal, diameter and the amount of glands and hair follicles vary between different dog breeds. The tympanic membrane separates the external from the middle ear and is normally concave with a dorso-ventral angle of about 45°. The upper pars flaccida is pink and vasculated, whereas the lower pars tensa has a translucent, slightly grey appearance. Attached to the medial surface one can see the manubrium of the malleus, the lower tip always pointing rostral. The middle ear is divided in the dorsal epitympanic recess, containing the head of the malleus and the important nerves. In the middle part the auditory ossicles are situated and opposite to the tympanic membrane there is the promontory. Caudally is the round window, which communicates with the cochlea of the bony labyrinth. During myringotomy and flushing of the bulla care must be taken, not to damage this structure! The ventral and largest part of the middle ear is also called tympanic bulla and is (in dogs) incompletely divided by a bony septum. The auditory tube connects the middle ear with the nasopharynx, starting in the medial wall of the bulla. The bulla is lined by a mucous membrane, consisting also goblet cells containing mucus. This mucus, together with adhered debris gets with the help of cilia constantly transported through the auditory tube.

Possible causes of otitis externa

Speaking of the aetiology of ear diseases not only primary and secondary causes, but also predisposing and perpetuating factors have to be evaluated:

Predisposing factors:

Increasing the risk of otitis

- Pendulous (heavy/hairy) pinnae
- Stenotic ear canals
- Excessive hair growth in ear canals
- Intense swimming
- Overproduction of cerumen
- Iatrogenic (hair plucking, trauma from cleaning, over cleaning)

Primary causes

Triggering an otitis

- Allergy
 - Atopic dermatitis
 - Adverse food reaction
 - Allergic contact dermatitis
- Parasites
 - *Otodectes*
 - *Demodex*
 - Ticks
- Endocrine and metabolic
 - Hypothyroidism

- Hyperadrenocorticism
 - Sex hormone abnormalities
 - Catabolic illness
 - Immunosuppression
- Miscellaneous
 - Foreign bodies
 - Naso-pharyngeal polyps
 - Idiopathic inflammatory/hyperplastic otitis of Cocker Spaniel
 - Eosinophilic granuloma complex
- Neoplasia
 - Ceruminous adenoma/adenocarcinoma
- Immune-mediated
 - Pemphigus
 - Lupus
 - Bullous pemphigoid
 - Drug reaction
- Keratinisation diseases
 - Primary idiopathic seborrhoea
 - Sebaceous adenitis
- Viral
 - Distemper

Secondary causes

Do not cause a diseases in a normal ear, but contribute or cause additional pathology in an already abnormal ear

- Bacteria
 - Staphylococci
 - Streptococci
 - Enterococci
 - Pseudomonas (may be also primary)
 - Proteus
 - E. coli
 - Klebsiella
 - Corynebacteria
- Yeast
 - Malassezia
 - Candida

Perpetuating factors

Occurring in response of an otitis, aggravating the inflammation and prevent the resolution of the otitis

- Oedema
- Epidermal hyperplasia and hyperkeratosis
- Dermal hyperplasia and fibrosis
- Calcification of pericartilaginous fibrous tissue
- Glandular hyperplasia and increased secretion
- Ear canal stenosis
- Decreased epidermal cell migration
- Tympanic membrane hyperplasia, diverticula, rupture
- Otitis media
- Osteomyelitis

Diagnostic procedures

In order to identify not only the secondary but also the primary causes, the predisposing and perpetuating factors of an otitis, several diagnostic tests are very helpful and necessary for a successful treatment of the dog's ear. The best way to approach an otitis externa is to start with a detailed dermatological anamnesis, followed by an examination of the whole animal, then looking at the pinnae, the ear canal and finally the microscopic examination of the discharge.

Otoscopic examination

Although otoscopic examination is a helpful tool to get an impression on the perpetuating factors (e.g. tympanic membrane), it is not always possible to perform this step at the initial consultation. Many dogs are too painful and even under sedation a highly oedematous ear canal cannot be penetrated by the otoscope, unless causing additional trauma...

Prefer the use of a video otoscope, as in general the light is more intense and it has a better magnification, making it easier to spot small foreign bodies. In addition the tympanic membrane can be better visualized (e.g. small tears).

Even if the otitis is unilateral, both ears should be inspected, starting with the less affected one. The pinna should be pulled firmly and then the vertical canal, the horizontal one and the tympanic membrane should be checked for foreign bodies, parasites, masses, inflammatory changes etc. Finally the condition of the tympanic membrane has to be assessed.

Cytology

Cytology of the exudate should always be performed initially and at each recheck. It can be best collected by using a cotton bud. If parasites are suspected, the debris can be mixed with liquid paraffin. Otherwise the cotton bud is gently rolled on a slide and then stained e.g. with Diff-Quick®. This allows the identification of bacteria, malassezia and cells.

Bacterial culture

In general bacterial culture is not always necessary. If there is no response to the treatment or if rods are detected a culture can be helpful in detecting the right antibiotics. However, as the ears are often treated topically, the reached concentration is usually much higher than the one used for the in vitro testing and can so often overcome resistance.

X-ray

Diagnostic imaging is a helpful tool to assess a suspected otitis media. When using X-ray dorso-ventral, right and left lateral obliques, as well as open mouth rostro-caudal views should be taken. This will need general anaesthesia. Unfortunately the sensitivity is regarded low.

CT and MRI

Computed tomography is a very sensitive and specific procedure to evaluate the middle ear. It is quicker than MRI, whereas MRI is better for imaging of soft-tissues.

Otitis media

Often dogs with otitis media show no symptoms at all. However hints for otitis media can be found in the anamnesis: chronicity of otitis externa (about 80% of the chronic cases have concomitant otitis media), refusing to eat bones, pain while yawning. Some dogs are painful on palpation of the bulla and a small percentage show neurological symptoms like Horner's syndrome, keratoconjunctivitis sicca, parasympathetic nose or facial paresis. On otoscopic examination an abnormal tympanic membrane, even when still intact is a hint for otitis media. Myringotomy might be necessary to obtain cytology from the middle ear. Always perform cytology as it is more sensitive than a bacterial

culture. Diagnostic imaging (CT, MRI and less X-ray) is also valuable to assess the extent of the damage and to formulate a prognosis.

Management of otitis

Ear flushing and myringotomy

The cleaning of the ear is an important part of the treatment. It accelerates the recovery in several ways:

- Reduction of the inflammatory exudate
 - Pus, which inactivates aminoglycosides and polymyxins
 - Free fatty acids
 - Debris, which protects the microbes
- Improvement of the efficacy of the medical treatment
- Reduction of pathogenic substances
 - Bacteria, yeasts
 - Bacterial toxins
- Elimination of small foreign bodies

If at the initial presentation the ear canals are painful and stenotic, start with cytology, bacterial culture if necessary and a medical treatment, which should include topic and/or systemic steroids for 7-10 days to reduce the oedema.

The cleaning should be performed under general anaesthesia. The endotracheal tube has to be cuffed carefully to prevent fluid aspiration through the Eustachian tube. For the cleaning a handheld otoscope along with a feeding tube or a urinary catheter can be used (connected to fluids an syringe by a 3-way tap). As mentioned before a video otoscope should be preferred. For flushing saline is safe to use, even if the tympanic membrane is ruptured. Chunky material can be efficiently removed by retrograde flushing. If necessary, ceruminolytics can be used (e.g. Cerumenex®). As they are mostly ototoxic they should not be used in cases of a ruptured tympanic membrane. However, this is sometimes still necessary to shorten the time of flushing and prevent maceration of the ear canal. If so, it should be only applied in the external ear canal, never directly in the middle ear and it should be thoroughly flushed afterwards. Ear curettes, loops and different forceps are also useful tubes in order to remove debris, foreign bodies, polyps or taking biopsies.

Once the external canal is clean, the tympanic membrane can be assessed. If necessary a myringotomy (to gain access to the bulla for taking samples and flushing) can be performed. With the help of a long needle the tympanic membrane should be punctured in the caudo-ventral region of the pars tensa, avoiding the dorsal part with the auditory ossicles and the vasculated pars flaccida. For flushing of the bulla I prefer a soft feeding tube. It should be inserted ventrally, and only flushed gently in order to prevent trauma of the round window, which would lead to permanent damage of the cochlea.

After the flushing the saline should be aspirated and certain ear drops can be directly instilled. Keep in mind that a thorough flushing is irritating, so topical steroids should always be applied directly afterwards. In some cases, where application of ear drops is difficult, an ear wick can be used. They are made of polyvinyl alcohol, which will expand, once placed in the ear and soaked with saline, Tris-EDTA and/or fluid ear drops. This expansion helps to prevent oedema/stenosis and as it acts like a sponge it helps to concentrate antibiotics in the ear canal. They have to be soaked regularly by the owner and should be removed after 7-10 days.

Medical treatment

Try always to identify and to manage the primary cause. Treating the secondary causes alone will improve the otitis, but it will recur! For successful management addressing and correcting the predisposing factors, such as swimming, is also crucial. Last but not least, perpetuating factors should be discussed with the owner, in order to increase their understanding of the otitis and to improve their compliance with long term treatment,

In order to choose the right medical treatment, cytology should always be performed to identify the causing agents. Also the nature of the exudate is important, as “oil should always be mixed with oil and water with water”.

Topical or systemic treatment

If possible always choose a topical treatment, as it reaches directly the inflamed parts. Additionally a high concentration can also overcome resistance, which is particularly in pseudomonas infections important. When the ear canal cannot be treated topically (e.g. pain, stenosis, compliance etc.) a systemic treatment is indicated. In severe infections it can also be combined with topical medicaments. Cefalexin, amoxicillin clavulanic acid are good first line drugs. In *Pseudomonas* otitis fluoroquinolones are the first choice.

Malassezia otitis

Normally topical treatment is sufficient. Miconazole and clotrimazole are appropriate and do not seem to be ototoxic, although the tympanic membrane is rarely ruptured in cases of malassezia otitis. Ketoconazole, nystatine and terbinafine are other options. Malassezia growth is inhibited by acid media, e.g. boric acid or acetic acid. Systemically ketoconazole 5-10mg/kg SID to BID itraconazole 5mg/kg SID or fluconazole 5-10mg/kg SID can be used.

Pseudomonas otitis

After cleaning the ear (if possible) with an acidic ear cleaner, topical and systemic treatment should be initiated. Useful topical antibiotics are enrofloxacin, gentamicin and marbofloxacin. In cases where these products are not sufficient tobramycin can be used. I like to mix them with TrisEDTA (damages the bacterial cell wall and increases the efficacy of the antibiotic) and silver sulphadiazine. In order to reduce the inflammation, dexamethasone should be added. In most countries topical eardrops with the mentioned components mixed are not commercially available... The most commonly used systemic antibiotics in *Pseudomonas* otitis are enrofloxacin 5-20mg/kg q24h, marbofloxacin 2.75-5.5mg/kg q24h, orbifloxacin 5.12.5mg/kg q24h and ciprofloxacin 5-10mg/kg q24h.

Ear cleaner

As with the ear flushing, do not use the in inflammatory and painful ears. After the initial therapy and flushing, dogs will normally tolerate a regular ear cleaning. Choose the appropriate ear cleaner based on the kind of exudate and your cytology and always demonstrate the owner, how to apply it. Bulb syringes are effective, if manual cleaning seems to be insufficient. However, the owners should be carefully instructed as the pressure can lead to a rupture of the tympanic membrane. Therefore a gap between the nozzle and the ear canal is important. As many dogs do not tolerate a bulb cleaning without sedation or anaesthesia, I use it very rarely.

Antibacterial compounds:

- Phytosphingosine
- Lactate acid
- Chlorhexidine
- Acetic acid
- Boric acid
- PCMX (parachloromethaxlenol)
- Salicylic acid
- TrisEDTA

Antifungal compounds:

- 2% Acetic acid
- Boric acid
- $\geq 2\%$ Chlohexidine

Ceruminolytic compounds/surfactants:

- Propylene glycol
- Mineral oil
- Glycerine
- Dioctyl Sodium Sulfosuccinat

Astringents:

Good for dogs, which go regularly swimming

- Alcohol
- Aluminium acetate
- Boric acid
- Salicylic acid
- Acetic acid
- Phytosphingosine

If the tympanic membrane is ruptured, ototoxic substances should be avoided. In these cases saline or TrisEDTA can be applied and if it has to be ceruminolytic, Mansfield and co-workers showed that squalene is a safe choice. Beginning with weekly cleaning is a good option, as overcleaning can result in maceration of the ear canal. As soon as epithelial migration returns, the cleaning can be stopped.

Ototoxicity

If the tympanic membrane is ruptured, several agents should be used carefully, as they have ototoxic potential:

- Propylene glycol
- Glycerine
- Mineral oil
- Dioctyl Sodium Succinate
- Calcium Sulfosuccinate
- Chlorhexidine $> 0.2\%$ (in cats marked toxicity even when $< 0.05\%$)
- Iodide $> 0.5\%$
- Antibiotika

- Aminoglycosides
- Polymyxin B
- Chloramphenicol
- Gentamycin in Otomax[®] (otherwise it seems to be safe)

One last word about primary secretory otitis media (PSOM)

Especially the Cavalier King Charles Spaniel seems to be predisposed to develop PSOM. It is an uncommon disease and the pathogenesis is not clear yet. Affected animals can present a variety of neurological symptoms, pain in the head and/or neck region, pruritus and impaired hearing. Sometimes otitis externa can be present. The tympanic membrane is usually opaque and bulging. MRI is helpful to distinguish PSOM from syringomyelia. After myringotomy, typical viscous mucus effusion can be removed from the tympanic bulla. Several bulla flushings might be necessary (up to 5 times). An alternative method might be the application of tympanostomy tubes.

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